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CONTENTS.

	PAGE.
ADVERTISEMENTS	153
APPLICATIONS FOR LETTERS PATENT	153
THE BRITISH ASSOCIATION	155
NEW COMETS	157
REVIEWS—	
Workshop Appliances	158
Principal Forbes	158
The Moon	159
Practical Assaying	159
Motion of Projectiles	160
REVIEWS (Continued)—	
Sewage Question	160
Scientific Handicraft	160
PROCEEDINGS OF THE INVENTORS' INSTITUTE	161
MONTHLY NOTICES	161
NEW PLANETS	162
FRESHWATER FISH	162
TRIBUNALS OF COMMERCE	162
GENERAL LITERATURE—	
The Sea and its Living Wonders	163
The Paradise of Birds	163
THE WRITING BALL	164
PATENT LAW MEETINGS AT BRADFORD	164
THE LOST CANON OF BEROSUS	164
HEAT IN GAS	164
DEATH OF AN OLD INVENTOR	164
CORRESPONDENCE	165
APPLICATIONS FOR LETTERS PATENT	165
THE EDUCATION OF THE HAND	165
ADVERTISEMENTS	165

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*** In this list (Com.) means Invention communicated from abroad.

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On July 15th.—2432 to 2443.—G. Whight. Railway rails and spikes for securing the same, and for other like purposes (com.)—G. Whight. Grate-bars for steam boiler and other furnaces (com.) F. P. Warren. Cooling the interiors of railway carriages and other vehicles, and apparatus and arrangements for the purpose.—R. A. Fisher. Preventing iron and steel from wasting away by oxidation, corrosion, or other causes, thereby preventing incrustation in steam boilers and water tuyeres (Complete specification.)—G. H. Swonnell. Heating malt kilns.—J. Jabor. Cooking apparatus.—J. H. Johnson. Steam washing apparatus (com.)—A. R. Donisthorpe, G. E. Donisthorpe, T. A. W. Clarke, W. H. Snowden, and B. Dearden. Manufacture of mixed yarns of

BRITISH MUSEUM

vegetable and animal fibre.—L. Gye. Firearms.—W. Wormald and E. Dobson. Sewing machines.—R. Knott. Treating sewage and other foul liquids, also partly applicable to bleaching and other cleansing operations.—T. Tinsley. Self-feeding copying brush with reservoir handle (com.)

On July 16th.—2444 to 2463.—H. Hewitt. Penholders.—E. J. W. Cooke and J. L. Emary. Construction of telescopes, microscopes, cameras, and other optical instruments.—S. E. Holten and F. H. Varley. Counting, indicating, and signalling apparatus, partly applicable to horological instruments.—P. Wilson. Double-drill plough, parts of which are applicable to other agricultural machines.—R. U. Etzensberger. Apparatus and arrangements for making infusions or extracts from substances.—W. Weldon. Absorbing dilute chlorine, and apparatus for that purpose.—E. C. Hamilton and W. R. Preston. Manufacture of artificial manures—E. Helm. Looms for weaving.—R. Harwood, G. Harwood, J. Scholes, and T. Seymour. Flues of steam boilers for effecting the economy of fuel.—J. Somerville and J. Robinson. Apparatus for discharging gas retorts.—F. Jacobson. Clarification and purification of sewage and the discharges of polluted waters from paper mills, printing works, dye works, and other factories by means of precipitation.—F. Jacobson. Clarification and purification of the polluted discharges from paper mills, printing works, dye works, and factories by means of precipitation.—N. S. Walker. Bale tie or buckle.—P. R. de F. d'Humy. Inkstands.—T. F. Lynch. Infants' feeding bottles and caps or covers for the same.—J. W. Mercer. Printing machines.—S. Thompson. Ice preservers or refrigerators.—J. H. Johnson. Injectors for feeding boilers (com.)—B. F. Weatherden, Hon. J. Colborne, and F. L. Barrington. Self-acting machinery or apparatus to be employed conjointly with a certain motive power for propelling ships and other navigable vessels, or for similar purposes.—J. Hickisson. Teats, rings, and other articles sucked by infants.

On July 17th.—2464 to 2471.—I. Bradley. Manufacture of solid-headed metallic cartridge cases (com.)—P. R. de F. d'Humy. Tea or coffee caddies or canisters.—H. Bezer. Means and apparatus for registering the distance travelled by each person in any vehicle, the distance passed over by the vehicle itself, and the time occupied by the journey.—W. A. Lamb. Floating docks or apparatus to facilitate the repairing of ships or vessels.—J. H. Banks. Production of printing surfaces and of engraved metal surfaces, applicable for other purposes.—P. Gamboni. Apparatus for producing and maintaining motive power, or assisting to produce and maintain such power.—E. G. Wright. Apparatus for cutting or reducing brewers' finings, applicable for other purposes.—J. A. Muller. Apparatus for measuring and registering the flow of water and other liquids.

On July 18th.—2472 to 2480.—A. Gow. Manufacture of bichromate of potash, or salts of similar commercial properties.—W. R. Harris. Means for facilitating the formation of wheel segment and rack patterns or models, or the production of toothed wheel segments and rack castings.—G. Moore and B. C. Le Moussu. Process of engraving on metal plates in relief.—D. O. Macomber. Rendering wood uninflammable.—W. Webster. Flat irons.—B. J. B. Mills. Carding engines, part of which improvements is applicable to other machines for combing fibrous materials (com.)—J. Poole. Billiard or dining tables, also suitable for other tables, bedsteads, or purposes requiring varied heights.—J. H. Johnson. Treatment of peat, and the machinery or apparatus employed therein (com.)—W. H. Thomas. Refrigerating apparatus applicable for preserving food and other purposes.

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On July 21st.—2499 to 2503.—T. R. Harding and T. W. Harding. Machinery for pointing wire used in the manufacture of needles, pins, card or hackle teeth, and for other purposes.—A. Neubecker. Refrigerators or apparatus for cooling worts.—H. J. Smith. Cards used for clothing the card cylinder of carding engines (com.)—A. J. Eastwood and R. Ainsworth. Machinery for cleaning the surface of cloths and hides.—C. G. Wheeler. Apparatus for distributing water and regulating and controlling the passage of fluids through pipes or tubes.

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On July 30th.—2577 to 2589.—A. Jaynor. Pneumatic telegraphic apparatus for transmitting messages or signals for ships, hotels, and other similar purposes.—J. Horrocks. Furnaces of steam generators, which improvements are or may be also applicable to furnaces for other purposes.—J. Woodley. Means or apparatus for trussing casks.—T. Black. Valves for steam engines, and apparatus or mechanism connected therewith.—J. Stephens. Treatment of excreta,

(Continued on page 165.)

Scientific and Literary Review,
OCTOBER 1, 1873.

BRITISH ASSOCIATION, 1873.

The meeting of the British Association which has just terminated is perhaps most notable as one of those in which solid scientific work, rather than sensationalism, has been the order of the day. It is, nevertheless, noteworthy in regard to the suggestion made by the President in his opening address, that, in this country, special provision should be made for higher education in science (technical inclusive), distinct and separate from our ordinary universities and colleges. We joyfully hail this utterance of Professor Williamson's (the president), as a recognition of the claims of Technological Education and technologists, such has we have been for some time past striving to bring to a practical solution; though we do not agree with the Professor in his views with regard to there being any great necessity for establishing separate universities and colleges, for teaching abstract or high class science *per se*, for, on the contrary, we consider that men of science of the highest type should possess a very considerable amount of knowledge of every branch of human learning; hence to them a university career in the present sense of the term must, therefore, be advantageous; in fact, the special colleges are needed for the advancement of practical science by improving the operations of the workshop, and the mental and industrial elevation of our workers. In short, we want a somewhat similar system applied to all arts and avocations which now exists in the medical profession, namely, training in special technical schools or colleges alone; or at option, of its combination with the ordinary university training. Viewing the proceedings of the British Association in this way, we have given them a place on our first page.

Proceedings of the Association.

At the meeting of the British association, on Sept. 18th, at Bradford Dr. A. W. Williamson, F.R.S., delivered the opening address, as president. After alluding to the fact that, but for the ill-health of Dr. Joule, he would have been a listener merely, upon that occasion, he proceeded as follows: "For a good many years past chemistry has been growing at a more and more rapid rate. I could not, if I would, give you to-night an outline of the chief newly-discovered compounds, with the various changes which they undergo, describing each of them by its own name (often a very long one) and recording the specific properties which give to each substance its highest scientific interest. But I am sure that you, would not wish me to do so if I could; for we do not meet here to study chemistry. I conceive that we meet here for the purpose of considering what this wondrous activity in our science means, what is the use of it, and what we can do to promote its advancement. Now, since the father of modern chemistry, the great Dalton, gave to chemists a firm hold of the idea of atoms, their labours have been continually guided by that fundamental idea. Every chemist who is investigating a new compound takes for granted that it must consist of a great number of atom-clusters (called by him molecules), all of them alike, and each molecule consisting of a certain number of atoms of at least two kinds. One of his first endeavours is to ascertain how many atoms of each kind there are in each molecule of the compound; and I want to draw your attention to the reasoning by which he judges of the value of the experiments when they agree among themselves, and to the meaning which he attaches to their result. If the result of his experiments does not nearly agree with any atomic formula (that is, if no conceivable cluster of atoms of the kinds known to be in the compound would on analysis give such results as those obtained), the chemist feels sure that his experiments must have been faulty—either the sample of substance which he worked upon containing foreign matter, or that his analysis was not made with due care. He sets to work again, and goes on till he arrives at a result which is consistent with his knowledge of the combining properties of atoms. Every good analysis of a pure compound leads to results which approximate to those required by the atomic theory, and chemists trust so thoroughly to the truth of that guide, that they correct the results of such analysis by the aid of it. The chemical idea of atoms serves for two purposes: 1. It gives a clear and consistent explanation of an immense number of facts discovered by experiment, and enables us to compare them with one another and to classify them. 2. It leads to the anticipation of new facts, by suggesting new compounds which may be made; at the same time it teaches us that no compounds can exist with their constituents in any other than atomic proportions, and that experiments which imply the existence of any such compound are faulty. Numberless new compounds have been discovered under the guidance of the idea of atoms; and in proportion as our knowledge of substances and of their properties became more extensive, and our view of their characteristics more accurate and general, so were we able to perceive the outlines of their natural arrangement, and to recognise the distinctive characteristics of various classes of substances. Among the improvements of our knowledge of atoms which have taken place, I ought to mention the better evaluations of the relative weight of atoms of different kinds which have been made since Dalton's time. More accurate experiments than those which were then on record have shown us that certain atoms are a little heavier or lighter than was then believed, and the work of perfecting our observations is constantly going on with the aid of better instruments and methods of operation. But, apart from these special corrections, a more sweeping change has taken place, not in consequence of more accurate experiments interpreted in the usual way, but in consequence of a more comprehensive view of the best experimental results which had been obtained, and a more consistent interpretation of them. Thus the atomic weight of carbon had been fixed at 6 by Dumas's admirable experiments; and it was quite conceivable that a still more perfect determination might slightly increase or diminish this number. But those who introduced the more sweeping change asserted in substance that two of these supposed atoms, whatever may be the precise weight of each, always are together, and never separate from one another; and they accordingly applied the term atom to that indivisible mass of carbon weighing twice as much as a carbon atom had been supposed to weigh. So also, with regard to other elements, it has been shown that many atoms are really twice as heavy as had been supposed, according to the original interpretation of the best experiments. This change was brought about by what I may be permitted to call the operation of stock-taking. Dalton first took stock of our quantitative facts in a businesslike manner; but the amount and variety of our chemical stock increased so enormously after his time that the second stock-taking absorbed the labours of several men for a good many years. One of the results of our endeavours to classify substances according to their natural resemblances has been the discovery of distinct family relationships among atoms, each family being distinguished by definite characteristics. Now, among the properties which thus characterise particular families of atoms, there is one of which the knowledge gradually worked out by the labours of an immense number of investigators must be admitted to constitute one of the most important additions ever made to our knowledge of these little masses. I will endeavour to explain it to you by a simple example. An atom of chlorine is able to combine with one atom of hydrogen or one atom of potassium; but it cannot combine with two atoms. An atom of oxygen, on the other hand, can combine with two atoms of hydrogen or with two atoms of potassium, or with one atom of hydrogen and one of potassium; but we cannot get it in combination with one atom of hydrogen or of potassium solely. Again, an atom of nitrogen is known in combination with three atoms of hydrogen; while an atom of carbon combines with four of hydrogen. Other atoms are classified, from their resemblance to these respectively, as monads, dyads, triads, tetrads, &c. The combining value which we thus recognise in the atoms of these several classes has led us naturally to a consideration of the order in which atoms are arranged in a molecule. Thus, in the compound of oxygen with hydrogen and potassium each of these latter atoms is directly combined with the oxygen, and the atom of oxygen serves as a connecting link between them. Hydrogen and potasium have never been found capable of uniting directly with one another; but when both combined with one atom of oxygen they are in what may be called indirect combination with one another through the medium of that oxygen. One of the great difficulties of chemistry some few years ago was to explain the constitution of isomeric compounds, those compounds, molecules of which contain atoms of like kinds and in equal numbers, but which differ from one another in their properties. Thus a molecule of common ether contains four atoms of carbon, ten atoms of hydrogen, and one of oxygen. Butylic alcohol, a very different substance, has precisely the same composition. We now know that in the former the atom of oxygen is in the middle of a chain of carbon atoms, whereas in the latter it is at one end of that chain. You might fancy it impossible to decide, upon anything like consistent evidence, such questions as this; but I can assure you that the atomic theory, as now used by chemists, leads frequently to conclusions of this kind, which are confirmed by independent observers, and command general assent. That these conclusions are, as far as they go, true descriptions of natural phenomena is shown by the fact that each of them serves in its turn as a stepping-stone to further discoveries. One other extension of our knowledge of atoms I must briefly mention, one which has as yet received but little attention, yet which will, I venture to think, be found servicable in the study of the forces which bring about chemical change. The original view of the constitution of molecules was statical; and the chemists only took cognisance of those changes of place among their atoms which result in the disappearance of the molecules employed, and the appearance of new molecules formed by their reaction on one another. I had occasion to point out a good many years ago that molecules which appeared to be chemically at rest are reacting on one another, when in suitable conditions, in the same kind of way as those which are manifestly in a state of chemical change. Thus a liquid mixture formed from two compounds contains molecules of four kinds, which we may describe as the two materials and the two products. The materials are reacting on one another, forming the products; and these products are, in their turn, reacting on one another, reproducing the materials. If one of the products of atomic exchange between two molecules is a solid while the other remains liquid (as when sodic chloride is mixed with silver nitrate), or if one is gaseous while the other remains liquid, so that the molecules of the one kind cannot react on those of the other kind and reproduce the materials, then the continued reaction of the materials on one another leads to their complete mutual decomposition. Such complete mutual decomposition of two salts takes place whenever they react on one another under such conditions that the products cannot react on one another and reproduce the materials; whereas partial decomposition takes place whenever the materials form a homogeneous mixture with the products. Now, if in any such homogeneous mixture more exchanges of atoms take place between the materials than between the products, the number of molecules of the products is increased, because more of them are being made than unmade; and, reciprocally, if more exchanges of atoms take place between the products than between the materials, the number of molecules of the materials is increased. The mixture remains of constant composition when there are in the unit of time as many decomposing changes as reproducing changes. Suppose that we were to determine by experiment the proportion between the number of molecules of the materials, and the number of molecules of the products, in a mixture the composition of which remains constant, and that we found, for instance, twice as many of materials as of products; what would this mean? Why, if every two couples of materials only effect in the unit of time as many exchanges as every one couple of products, every couple of materials is only exchanging half as fast as every couple of products, In fact, you perceive that a determination of the proportion in which the substances are present in such a mixture will give us a measure of the relative velocities of those particular atomic motions; and we may thus express our result: The force of chemical combination is inversely proportional to the number of atomic interchanges. Chemists are examining the combining properties of atoms, and getting clear ideas of the constitution of matter. Admitting, then, for the present, that such is the meaning of chemical work, we have to consider the important question of its use. What habits of mind does it engender? What powers does it develop? The requirements on the part of an investigator are accuracy in observing the phenomena with which he deals, accuracy of memory, and accuracy in manual operations in all experimental inquiries; many of them affording scope for very considerable skill and dexterity. These elementary qualities are well known to be requisite for success in experimental science, and to be developed by careful practice of its methods; but some higher qualities are quite as necessary as these in all but the most rudimentary manipulations, and are developed in a remarkable degree by the higher work of science. Thus it is of importance to notice that a singularly good training in the proper use of words is afforded by experimental chemistry. Accuracy of reasoning is no less effectively promoted by the work of experimental chemistry. Those who tread the path of original inquiry, and add to human knowledge by their experiments, are bound to practice this habit with the most scrupulous fidelity and care, or many and grave would be the mistakes they would make. Another habit of mind which is indispensable for success in experimental chemistry, and which is taught by the practice of its various operations, is that of truthfulness. Error comes before the investigator usually in the very garb of truth; and his utmost skill and attention are needed to decide whether or not it is entitled to retain that garb. True ideas of a natural phenomenon confirm and strengthen one another; and he who aids directly the development of one of them is sure to promote indirectly the consolidation of others. Each onward step in the search for truth has made us stronger for the work; and when we look back upon what has been done by the efforts of so many workers simply but steadily directed by truth towards further truth, we see that they have achieved, for the benefit of the human race, the conquest of a systematic body of truths which encourages men to similar efforts, while affording them the most effectual guidance. This lesson of the inherent vitality of truth, which is taught us so clearly by the history of our science, is well worthy of the consideration of those who, seeing that iniquity and falsehood so frequently triumph for a while in the struggle for existence, are inclined to take a desponding view of human affairs, and almost to despair of the ultimate predominance of truth and goodness. I believe it would be impossible at the present time to form an adequate idea of the vast consequences which will follow from the national adoption of systematic measures for allowing our knowledge of truth to develop itself freely, through the labours of those who are willing and able to devote themselves to its service, so as to strengthen more and more the belief and trust of mankind in its guidance, in small matters as well as in the highest and most important considerations. Chemistry presents peculiar advantages for educational purposes in the combination of breadth and accuracy in the training which it affords; and I am inclined to think that, in this respect, it is at present unequalled. There is reason to believe that it will play an important part in general education, and render valuable services to it in conjunction with other scientific and with literary studies. I trust that the facts which I have submitted to your consideration may suffice to show you how fallacious is that materialistic idea of physicial science which represents it as leading away from the study of man's noblest faculties, and from a sympathy with his most elevated aspirations, towards mere inanimate matter. The material work of science is directed by ideas towards the attainment of further ideas. Each step in science is an addition to our ideas, or an improvement of them. A science is but a body of ideas respecting the order of nature. Each idea which forms part of physical science has been derived from observation of nature, and has been tested again and again in the most various ways by reference to nature; but this very soundness of our materials enables us to raise upon the rock of truth a loftier structure of ideas than could be erected on any other foundation by the aid of uncertain materials. The first thing wanted for the work of advancing science is a supply of well-qualified workers. The second thing is to place and keep them under the conditions most favourable to their efficient activity. The most suitable men must be found while still young to be trained to the work, for which we want a system which shall give them favourable opportunities of acquiring a clear and thorough knowledge of some few truths of nature, and shall supply to each student who has the power and the will to conduct researches, all material conditions which are requisite for the purpose. Let the most intelligent and studious children from every primary school be sent, free of expense, to the most accessible secondary school for one year; let the best of these be selected and allowed to continue for a second year: and so on, until the *élite* of them have learnt all that has to be learnt to advantage. Let the best pupils from the secondary schools be sent to a college of their own selection, and there subjected to a similar process of annual weeding: and, finally, let those who get satisfactorily to the end of a college curriculum be supplied with an allowance sufficient for their maintenance for a year, on condition of their devoting their undivided energies to research, under the inspection of competent college authorities, while allowed such aids and facilities as the college can supply with the addition of money grants for special purposes. Let all who do well during this first year be allowed similar advantages for a second and even a third year. Each young investigator thus trained must exert himself to obtain some appointment which may enable him to do the most useful and creditable of which he is capable, while combining the conditions most favourable to his improvement. Let there be in every college as many professorships and assistantships in each branch of science as are needed for the efficient conduct of the work there going on, and let every professor and assistant have such salary and such funds for apparatus, &c., as may enable him to devote all his powers to the duties of his post, under conditions favourable to the success of those duties; but let each professor receive also a proportion of the fees paid by his pupils, so that it may be his direct interest to do his work with the utmost attainable efficiency, and attract more pupils. Let every college and school be governed by an independent body of men, striving to increase its usefulness and reputation, by sympathy with the labours of the working staff, by material aid to them when needed, and by getting the very best man they can, from their own or any other college, to supply each vacancy as it arises. In addition to colleges, which are and always have been the chief institutions for the advancement of learning, establishments for the observation of special phenomena are frequently needed, and will doubtless be found desirable in aid of a general system for the advancement of science. Now, if a system fulfilling the conditions which I have thus briefly sketched out were once properly established on a sufficient scale, it ought to develop and improve itself by the very process of its working; and it behoves us, in judging of the system, to consider how such development and improvement would come about. There is an urgent need of accurate scientific knowledge for the direction of manufacturing processes, and there could not be a greater mistake than to suppose that such knowledge need not go beyond the elementary truths of science. Dr. Williamson concluded an able and eloquent address by urging upon his hearers the vital necessity for an onward movement in natural education as necessary for the advancement of science generally. Upon taking his seat he was greeted with loud applause.

MATHEMATICS AND PHYSICAL SECTION, Sept. 18th.

On the 18th of September, Professor H. Smith, F.R.S., the President, gave an address, in the course of which he said he thought that the British Association should try to improve and extend scientific education. It had already appointed a committee to aid in the improvement of geometrical teaching in this country, and had shown sound judgment in their work. Public opinion should be raised in favour of one definite text book for schools, improving upon the old method of teaching geometry, and the British Association should give the whole weight of its influence to the proposed change. A good school course of education should include part or parts of physics, chemistry, and biology—a committee of the British Association to report on the teaching of natural science in schools. Science was not only practically useful, but was a good training for the mental faculties. It expanded the mind of the young, and made them feel something of the greatness of the sublime regularity and the impenetrable mystery of the world in which they were placed. Thus it trains the growing faculties, and aids in the education of the senses. He spoke of the aid given by the Government to museums and to zoology, and the very little aid it gave to physical science, adding that the Government should establish institutions to teach the latter. He hoped that pure mathematics would also come in for a modest share of State aid. The papers read in this section were, as usual, almost exclusively of a technical character.

GEOLOGICAL SECTION met in Horton-lane Schoolroom. Professor Phillips took the chair, and in his opening address pointed, in proof of the valuable aid of geology to industry, to its explorations of the ironstone formations of England, and the question which was now being put to it, to determine the extent of the British coalfields, and their probable duration. In the vale of York the great coal deposit, extending from Bradford to Nottingham, passes under the magnesian limestone, and might be found within attainable depths. To ascertain the fact, costly experiments must be made, which would require to be directed by geology. The effort to ascertain what was under the wealden should not be allowed to come to a premature end, as it would determine whether the older rocks found in Belgium lay beneath the wealden, and with them coal. The President proceeded to refer to the investigations into the physical revolutions through which the earth had passed. The investigations now going on in the limestone cliffs not far from the place of meeting were helping to clear up the history of mammalia in Great Britain. In Kirkdale Cave traces of human art appeared. Kent's Hole had given proofs of the presence of man from the earliest period, characterised by the remains of the great bear, and both there and in the cave near Settle, at much later periods, domestic occupation was fully established. Professor Phillips then pointed out the progress yet to be made in geology, and said the share which the British Association had taken in the work was considerable, and might with advantage be increased. Papers were read in this section on the "Geology of the Bradford District." The biology section was divided into three departments. The general address was given by Dr. Allman, who referred to the question of distribution, and its connection with the doctrine of evolution. The doctrine of evolution had given a new direction to logical study, and a powerful influence to all future researches. It was the highest expression of the fundamental principle established by Mr. Darwin, and depended upon two admitted faculties of the human being—the transferring of character from the parent to the offspring, and the capacity of having these characters modified by external agencies and by a spontaneous tendency to variation. But, with all their admiration for evolution, they could not shut their eyes to the difficulties that existed for accepting it. One of the greatest of these was the unbroken continuity of inherited life which it necessarily required through a period of time, the vastness of which was such that the mind of man was thoroughly incapable of comprehending.

In the Anthropology Department of this section, Dr. Beddoe gave an address on the "Anthropology of Yorkshire."

GEOGRAPHIC SECTION.

Sir Rutherford Alcock presided over the Geographic section, which met in the Mechanics' Institute. In his opening address, the line of delineation between Afghan and Persia has been decided by the labours of the Arbitration Commission. The delimitation fixed by the British Government on the Upper Oxus by similar action is a pledge of peace with Russia. There is no nation, perhaps, which has so much reason to value geographical science and the art of map-making at so high a rate as the Russians. In their rapid advance across the steppes and mountain ranges of Northern Asia southward into the valley of the Amoor, and Manchuria in the east, and to Khiva and Samarcand in the west, they have taken many courses. But in all they have had the immense advantage of not only knowing the territories they coveted, but being able to place them accurately on maps. The latest advance of Russia was fixed at Kulja, where she had established a trading centre, obviously dictated by a knowledge of the geographical features, giving her access to Eastern Turkestan, enabling her to push her trade on to China. There was an intimate connection between history and geography, and they must be studied together. The part which Russia plays in the history of Europe and Asia, and the future which may yet be reserved for that empire, are more a matter of physical geography than of politics or of policy, if we look to determining causes. What was Russia to do, frozen in between two seas, and with closed ports for more than six months in each year, but by an infallible instinct (in nations, as individuals, often exemplified) stretch out feelers towards the open waters, and more genial climates? We have heard much of Russia's destiny driving her southwards to the Bosphorous and eastward, in the same parallel, over the rich valleys of central and tropical Asia; but is it not a geographical necessity, far more than a political ambition, which has thus far driven her across the whole breadth of Asia, until she gained the Chinese ports on the Pacific, and southwards towards the mouths of the Danube, the sunny spots of the Mediterranean, and the head of the Persian Gulf? It not only was a natural tendency, but as natural as the descent of the glacier to the valleys, forging downwards by a slow, but irresistible pressure. After pointing out the vast fields which remained for exploration in the interest of commerce, the president expressed the opinion that the establishment of fairs at suitable parts was the best means of developing trade in the East, as the native merchants would attend these, and be better distributors than English agents. Access to the southern route through Burmah were all difficulties overcome (and they are neither few nor slight), promises little in comparison with a more direct outlet for the Assam teas, and an interchange of goods and produce with the populations of Thibet, Turkestan, and Central Asia generally. The valley and passes of the Chitral are beset by many difficulties physical and political, but not more than a Government like India may surmount. As regards access by Sikkim there ought to be decision and prompt action.

Papers were read in this section on Khiva, Turcomania, and Persia.

ECONOMIC STATISTICS SECTION, Sept. 18th.

Mr. Forster, M.P., presided. An interesting discussion arose on a paper read by Mr. Haughton on "Railway Amalgamation." In this paper Government management was objected to, and also the present system of management—first, because the work would be immense for any Government department to undertake, and because it would not pay. The existing system was considered unequal to the necessities of the age and the wants and demands of the public. As a compromise between both he proposed that all the companies should be amalgamated into four groups, three of which would run north and south from Inverness to Dover, viz., London and North-Western group, Great Northern group, Midland group, and the Great Western group, which would extend from Land's End, Liverpool, and Manchester to London. That scheme, it was admitted, would meet the present wants of the day, and he advanced it for the public interest and to endeavour to provide for the welfare of the people.

Mr. Hyde Clarke, F.S.S., read a paper entitled "Influence of Large Centres of Population on Intellectual Manifestations." Town populations, while exhausting rural populations physically, he showed to have the intellectual superiority, and this to a certain extent in the ratio of greater population. From the example of the smaler collegiate and cathedral cities, however, he maintained that the development was continuous, and dependent on the long-continued influence of higher educational culture.

Papers were also read by Mr. W. Hastings on "Postal Reform," by Mr. J. A. Binns on "Benefit Building Societies," and by Mr. James Hanson on "The Educational Statistics of Bradford." The day's proceedings in this section were of a most interesting character.

Mr. W. H. Barlow, F.R.S., presided in the Mechanical Science Section, and the papers read included one by Mr. W. E. Newton, C.E., on "Tilghman's Sand Blast Process for cutting hard substances."

The Chemical Section met under the presidency of Professor W. J. Russell.

A soirée took place in the evening in St. George's Hall.

NEW COMETS.

BORELLY's comet (to be known as III. 1873, that discovered by Tempel on July 3 ranking as II. 1873) was discovered by him at Marseilles on the night of August 20, in the constellation Gemini, moving rapidly towards the south. It was examined shortly afterwards by MM. Wolf and Rayet. They describe it as presenting the form of a circular nebulosity about 2′ in diameter, with a tolerably brilliant nucleus in the centre. The spectroscope showed a continuous spectrum extending from the yellow to the violet, due in part to the reflected solar light, and two luminous bands, the one in the green, the other in the blue. The green band was intense, sharply defined towards the red, but diffused towards the violet; the blue band (the brightness of which was not half that of the other) was also defined towards the red and diffused towards the violet. "The continuous spectrum," add the observers, "is much brighter than the spectra of the comets which we have previously examined, and is much narrower. Perhaps it is due to a solid nucleus."

The other comet (also announced in the *Athenæum*, and to be known as comet IV. 1873) was discovered by M. Paul Henry, at Paris, on the night of August 23, in the constellation Lynx. He described it as "round, very brilliant, almost visible to the naked eye, and with a central condensation."

Prof. Edmund Weiss, of Vienna, has calculated an orbit of Borelly's comet with the materials available up to August 24, by which it appears that it will be in perihelion about September ·11, but will continue to approach nearer the earth for some time after that. According to his ephemeris, the places in the heavens in the following nights will be about these:—

	R.A.		N.P.D.
	h.m.		° ′
Sept. 5	7·54	....	72·12
,, 9	8· 3	....	79·43
,, 13	8·15	....	88·12
,, 17	8·28	....	97·28

Unfortunately, the moon interferes very much at present with the observation of comets and other faint objects. At the time of its waning, this comet will have increased very considerably in brightness, and will, probably, be extensively observed.—*Athenæum*.

Reviews.

Workshop Appliances, including Descriptions of the Gauging and Measuring Instruments, the Hand Cutting Tools, Lathes, Drilling, Planing, and other Machine Tools used by Engineers. By C. P. B. Shelley, Civil Engineer, Honorary Fellow of and Professor of Manufacturing Art and Machinery in King's College, London. London: Longmans, Green and Co. 1873.

The various means now open to a student to obtain in a practical way anything like a fair knowledge of the general range of a handicraft or profession, such as that of an engineer, for instance, are, owing to the prevalence of division and sub-division, very scanty, and although there are books already published describing the different tools and appliances, together with the modes of using them, and rules for their application, yet at present he must be content with studying works like that now before us in order to gain general knowledge of his handicraft or trade, and so perchance, if opportunity were afforded him, of applying some, at least, of the rules, he might, by diligently following out such rules, gain such an amount of knowledge of the practical portion as would fit him to compete with a fair prospect of success for those scholarships to which the name of Sir Joseph Whitworth, Bart., is so nobly attached.

The work under notice forms another of that series of text-books issued by Messrs. Longman, of which we have before spoken in terms of commendation; and this one may fairly rank as one of the best of the series that have up to the present time been issued. To those who intend to compete for the Whitworth Scholarships this work will be of great value; in fact, one of its great aims is to aid those who intend to offer themselves as candidates for the honourable distinction we have referred to. Its pages will be found to contain a description of the various appliances and tools enumerated at the head of this notice, and of others which may be termed offshoots of them. For, as the author rightly observes, "The student, in making himself familiar with the appliances described, will but be following in the steps of many of our most eminent civil engineers, some of whom have made improvements in mechanism, upon which, however trivial they may appear in themselves, have depended the success of the most brilliant of their achievements."

In the introductory chapter of this work Mr. Shelley says, speaking of inventors and their inventions, "that they are indebted to their fellow labourers (by which term we anticipate he means the manufacturers), who—by the introduction of appliances known as machine tools, &c., have rendered feasible the carrying out of their suggestions, and the performance of operations which before were utterly impracticable—have strong claims to a share of the credit." To this we offer no objection, for we agree with him that they are fully entitled to "a share of the credit" in rendering the invention a practical reality; but we would ask, is it not a fact which receives almost daily confirmation that a manufacturer is not content with "*a share*," but must forsooth take the *whole?* In reference to the introduction of the metric system into England the author says:—

"Those who desire the overthrow of our present system for the sake of uniformity can hardly be aware of the sacrifices they would impose upon the manufacturing industry of the United Kingdom, nor can they consider the extent of the change which, for the time being, would carry the inconvenience of a mixed system throughout the enormous area over which the English language is spoken. Moreover, the loss which would be caused by the alteration or replacement of all the present guages and measuring apparatus, and of many of the machines and tools used in our workshops, which would in itself be sufficiently considerable, would probably be a less serious matter than the overthrow of all the practical data and rules of calculation, by the use of which we have arrived at our present superiority in mechanical manufactures; so that there is little doubt that the disadvantages involved in the adoption of the metre, or any other new standard, would much more than counterbalance the advantage of having the same language of measure.

"These, and other considerations, led Sir J. Whitworth to suggest the retention of the inch, which is, in fact, *the* unit of length for mechanical purposes, its subdivisions only being changed from vulgar to decimal fractions. This simple alteration provides us with the means of recording measurements of any required degree of minuteness, and, so far from provoking the opposition which the attempt to implant an entirely new system would encounter, it has already made great progress towards general adoption."

This view of the case we would recommend to those who advocate the introduction of the metric system. For our part, we would be glad to see the suggestion of Sir J. Whitworth develop itself so as to become more general, and we learn with satisfaction that there is hope for such a result. Our space does not permit our giving further quotations, so we must refer our readers to the work itself, and we doubt not that they will be amply repaid by its perusal. Although the author states his reason for not going into the description of the steam hammer and other well-known contrivances usually found in an engineering establishment of any great magnitude, yet, we would suggest that, if another edition of this work were called for, a description of the action of the steam hammer with illustrations should at least be given.

Principal Forbes and his Biographers. By John Tyndall. London: Longmans, Green, and Co. 1873.

It is reported that it was common remark amongst those outside the pale of the early Christian Church, "See how these Christians love one another;" but the *raison d'etre* of this work might lead to the saying, "See how these scientifics hate each other." The preface of this pamphlet affords a sufficient *exposé* of its contents of it:—

Therein Prof. Tyndall says:—In the summer of 1856, in company with my friend Professor Huxley, and, indeed, at his suggestion, I visited the glaciers of the Alps, with a view to their investigation. The visit was the immediate outgrowth of my previous work on "Slaty Cleavage." On January 15, 1857, it fell to my lot to make our joint observations known to the Royal Society. The communication produced, I was informed, great discontent in Edinburgh; and various protests regarding it came from scientific men there to their London friends. This I regretted and deprecated; for, besides misinterpreting the object of the paper, I thought it evinced a desire to label the glaciers of the Alps with the name of a single investigator, to the exclusion of all others, thus contracting what ought to be a broad scientific question to a mere personal one. A glimpse of the effect produced by our communication is given at page 369 of the "Life of Principal Forbes," recently published by my friend Mr. Macmillan.

I could not, however, believe in the permanence of so unreasonable a state of mind, and on June 4, 1858, in a Friday evening discourse on the Mer de Glace I took particular pains to demonstrate that I was absolutely devoid of any hostile feeling towards Professor Forbes. I had occasion to refer to a mistake of his, and I introduced the subject, and followed it up by an expression of opinion regarding him in these words:—"Too much weight must not be attached to this explanation. It is one of those suggestions which are perpetually thrown out by men of science during the course of an investigation, and the fulfilment or non-fulfilment of which cannot materially affect the merits of the investigator. Indeed, the merits of Forbes must be judged on much broader grounds, and the more his labours are compared with those of other observers, the more prominently does his comparative intellectual magnitude come forward. I will not content myself with saying that the book of Professor Forbes is the best book that has been written upon the subject; the qualities of mind, and the scientific culture invested in that excellent work, are such as to make it, in the estimation of the physical investigator at least, outweigh all other books upon the subject taken together. But while thus acknowledging its merits, let a free and frank comparison of its statements with facts be instituted."

To my regret, however, it soon became clear to me that this "free and frank comparison" would be tolerated on one condition alone, and that is, that its results should be mere confirmations of the views previously enunciated by Professor Forbes. No lover of freedom would willingly yield to such an attempt to fetter him. Discussion waxed warm, and considerable men, some of them by no means tender to me or to my work, mingled in the controversy. On one occasion, as I was informed at the time, an eminent philosopher went so far as to state that the only contribution I had ever made to our knowledge of the glaciers was to take Auguste Balmat to the summit of Mont Blanc, and cause him to be frost-bitten. However, matters mended afterwards, and some years subsequent to the occasion here referred to, at his own initiative, I had the pleasure of conversing most amicably about Alpine glaciers with this same philosopher. This and other severities I permitted to pass without remonstrance at the time, and not till whispered threats of further punishment became intolerable did I resolve to make myself more fully acquainted with the history of the subject, and bring these rumours to an issue in the "Glaciers of the Alps."

My original intention regarding that work, and my reasons for deviating from it, are given at the close of the introductory chapter in these words:—"When the idea of writing this book first occurred to me, it was not my intention to confine myself to the glaciers alone, but to make the work a vehicle for the familiar explanation of such general physical phenomena as had come under my notice. Nor did I intend to address it to a cultured man of science, but to a youth of average intelligence, furnished with the education which England now offers to the young. I wished, indeed, to make it a boys' class-book, which should reveal the mode of life, as well as the scientific objects, of an explorer of the Alps. The incidents of the past year have caused me to deviate in some degree from this intention."

The "incidents" here referred to are those noticed above; and they gave to certain pages of the "Glaciers of the Alps" a controversial tone which I should have been only too happy to avoid.

Accident in 1872 led to the realisation of my first intention, and caused me to publish a boys' book of the glaciers. How the book originated is hereafter shown. I thought it innocent; others, I regret to say, think it the reverse; and they have expressed their thoughts in the "Life of Principal Forbes" referred to above. I am challenged to meet their criticisms, which, I find, are considered to be conclusive by some able public journals and magazines. Thus the attitude of a controversialist is once more forced upon me. Since the death of Principal Forbes no one has heard me utter a word inconsistent with tenderness for his memory; and it is with an unwillingness amounting to repugnance that I now defend myself across his grave. His biographers profess to know what he would have done were he alive, and hold themselves to be the simple executors of his will. I cannot act entirely upon this assumption, or deal with the dead as I should with the living. Hence, though these pages may appear to some to be sufficiently full, they lack the completeness, and still more the strength, which I should have sought to confer upon them had my present position been forced upon me by Principal Forbes himself instead of by his friends.

I think it on every account deplorable that this controversy should have been revived. Two extracts will show the bitter form it assumed at the outset. The first is from the ablest of northern journals, the *Scotsman*; the second from the high-toned and intellectual New York *Nation*. In a review of the "Life and Letters of Principal Forbes,"[*] the *Scotsman* says:—

"The first manifestation of opposition came from M. Agassiz, who, immediately after the announcement by Forbes, in 1842, of his discovery of the veined structure of glaciers, wrote a paper in the same journal, claiming the discovery as his own. . . . Forbes answered M. Agassiz, in 1843, in a paper (which Professor Tait has printed in an appendix), giving a circumstantial narrative of the whole affair, backed by testimony. If ever a man stood convicted of misstatement and self-contradiction, M. Agassiz seems to us to be in that position. Yet no attempt has been made during all these thirty years to controvert or answer the charge."

The reviewer further honours me with this and other references, accompanied by various reflections and implications:—

"The most persistent opponent of Forbes's reputation has been Professor Tyndall. It is well known, however, to those behind the scenes that he has not been alone in his hostility; he only represents a certain *coterie* in the Royal Society who from their metropolitan eminence affect to look down on everything provincial."

From this imaginative picture I turn to the review in the *Nation*; it runs thus:—

"The authors of the 'Life and Letters' have given us from Forbes's own letters all that was necessary to show a course of duplicity towards the man with whom, to quote his own words, he 'served his apprenticeship in glacier observation,' unparalleled in the annals of science. If justice to the dead could not suffer such mild statements as those of Tyndall to pass unanswered, it is high time that the insults which have been heaped upon the living by Forbes himself during his lifetime, and by his friends since his death, should be noticed. Professor Agassiz, who has been the object of all this abuse, never defends himself against personal attacks; he can well afford to leave to posterity the decision of his claims; but he must pardon his friends it they come forward now and make a plain statement of the other side of the question."

The Moon: Her Motions, Aspect, Scenery and Physical Condition. By Richard A. Proctor, B.A., Cambridge, Honorary Secretary of the Royal Astronomical Society, &c., &c. With three lunar photographs by Rutherford (enlarged by Brothers), and many plates, charts, &c. London: Longmans, Green, and Co. 1873.

This is a work that every student of astronomy may read with pleasure and profit.

To give the reader a definitive statement of the contents of this work would be to write an epitome which would be manifestly unfair to the reader and the author, as it would be the substitution of one man's work for another's. We can, however, glance at a character of its contents, mentioning that it treats of the moon's distance, size, and mass; the moon's motions; the moon's changes of aspect—rotation, libration; study of the moon's surface; lunar celestial phenomena; condition of the moon's surface; and a comprehensive index to the map of the moon. As likely to interest the reader, we may quote the following passages. In reference to the moon's motions, Mr. Proctor, after a very readable and lucid exposition of Newton's law of gravitation and its applicability to the motions of the moon, proceeds as follows:—

Newton had therefore only to determine whether the force continually deflecting the moon from the tangent to her path is equal in amount to the force of terrestrial gravity reduced in accordance with this law of inverse squares, in order to obtain at least a first test of the correctness of the theory which had suggested itself to his mind.

Mr. Proctor then, by the aid of diagrams, states the steps of Newton's calculation, and that it resulted in a discordance too great to admit of being reconciled in any way with the theory he had conceived. If the deflection of the moon's path had given a result greater than the actual value of gravity, he could have explained the discrepancy as due to the circumstance that the moon's own mass adds to the attraction between the earth and herself. But a less value was quite inexplicable. He therefore laid aside the investigation.

Fourteen years later Newton's attention was again attracted to the subject, by a remark in a letter addressed to him by Dr. Hooke, to the effect that a body attracted by a force varying inversely as the square of the distance, would travel in an elliptic orbit, having the centre of force in one of the *foci*. I do not at present pause to explain this remark, which is indeed only introduced here to indicate the sequence of Newton's researches. It is to be noted that Hooke gave no proof of the truth of his remark; nor was there anything in his letter to show that he had established the relation. He was not, indeed, endowed with such mathematical abilities as would have been needed (in his day) to master the problem in question. Newton, however, grappled with it at once, and before long the idea suggested by Hooke had been mathematically demonstrated by Newton. Yet, even in ascribing the idea to Hooke's suggestion at this epoch, we must not forget that Newton, in the very circumstance that he had discussed the moon's motion as possibly ruled by the earth's attraction, had implicitly entertained the idea now first explicity enunciated by Hooke: for the moon does not move in a circle around the earth, but in an ellipse.

The following, on the condition of the moon's surface, will interest many of our readers:—

It is not difficult to show reasons at least for believing that the face of the moon must be changing more rapidly than that of our earth. On the earth, indeed, we have active subterranean forces which may, perhaps, be wanting in the moon. On the earth, again, we have a sea acting constantly upon the shore,—here removing great masses, there using the *debris* to beat down other parts of the coast, and by the mere effect of accumulated land-spoils acquiring power for fresh inroads. We have, moreover, wind and rain, river action, and glacial action, and, lastly, the work of living creatures by land and by sea, while most of these causes of change may be regarded as probably, and some as certainly, wanting in the case of our satellite. Nevertheless, there are processes at work out yonder which must be as active, one cannot but believe, as any of those which affect our earth. In each lunation, the moon's surface undergoes changes of temperature which should suffice to disintegrate large portions of her surface, and with time to crumble her loftiest mountains into shapeless heaps. In the long lunar night of fourteen days, a cold far exceeding the intensest ever produced in terrestrial experiments must exist over the whole of the unilluminated hemisphere; and under the influence of this cold all the substances composing the moon's crust must shrink to their least dimensions—not all equally (in this we find a circumstance increasing the energy of the disintegrating forces), but each according to the quality which our physicists denominate the coefficient of expansion. Then comes on the long lunar day, at first dissipating the intense cold, then gradully raising the substance of the lunar crust to a higher and higher degree of heat, until (if the inferences of our most skilful physicists, and the evidence obtained from our most powerful means of experiment can be trusted) the surface of the moon burns (one may almost say) with a heat of some 500° F. Under this tremendous heat all the substances which had shrunk to their least dimensions must expand according to their various degrees; not greatly, indeed, so far as any small quantity of matter is affected, but to an important amount when large areas of the moon's surface are considered. Remembering the effects which take place on our earth, in the mere change from the frost of winter to the moderate warmth of early spring, it is difficult to conceive that such remarkable contraction and expansion can take place in a surface presumably less coherent than the relatively moist and plastic substances comprising the terrestrial crust, without gradually effecting the demolition of the steeper lunar elevations. When we consider, further, that these processes are repeated not year by year, but month by month, and that all the circumstances attending them are calculated to render them most effective because so slow, steadfast, and uniform in their progression, it certainly does not seem wonderful that our telescopists should from time to time recognize signs of change in the moon's face. So far from rejecting these as incredible, we should consider the wonder rather to be that they are not more commonly seen, and more striking in their nature. Assuredly there is nothing which should lead our telescopists to turn from the study of the moon, as though it were hopeless to seek for signs of change on a surface so desolate. Rather they should increase the care with which they pursue their observations, holding confidently the assurance that there are signs of change to be detected, and that in all probability the recognition of such change may throw an instructive light on the moon's present condition, past history, and probable future.

A Manual of Practical Assaying. By John Mitchell, F.C.S. Fourth edition. Edited by William Crookes, F.R.S., &c. London: Longmans, Green, and Co. 1873.

This is a new edition of a standard work, criticism on the general character and construction of which is altogther out of place, inasmuch as it has now passed beyond the stage of trial into that of practical use and adoption; and that it has been found to give general satisfaction is fully proved by the fact that this is the fourth edition of a work, which is no mere skim-the-surface production, a few pages in compass, but a thoroughly practical work of detailed information, extending to nearly 900 pages. Mr. Mitchell's work, as some of our readers may be aware, is based on "Berthier's Traité des Essais par la Voie Séche." The mechanical and chemical operations of assaying are treated in full, inclusive of a description of the apparatus required, their mode of use, &c., also furnaces, fuel, and crucibles, together with a description of the best pyrometers, and their applications are not forgotten, nor are the use of the blowpipe, and all the appurtenances; as fluxes, supports, &c. The action of the fluxes on some mineral substances are treated of, as also the discrimination of many minerals by means of the blowpipe, aided by a few tests by the humid method, and the humid analysis of many mineral substances, their composition, locality, &c., receive particular notice, as likewise does the complete assay of all the common metals, in addition to which the assay of sulphur, chromium, arsenic, heating power of fuel, &c., are fully discussed; and a copious table drawn up for the purpose of ascertaining in assays of gold and silver the precise amount, in ounces, pennyweights, and grains of noble metal contained in a ton of ore from the assay of a given quantity.

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[*] For a critical notice of this work, see Monthly Notices for last month (September number of this journal).

The work has since its first appearance been subject to the revision of Dr. Röhrig, M.E., who incorporated into it various Continental improvements, as set forth in Professor Kerl's *Probirkunst*; and in this fourth edition Mr. Crookes has carefully revised the whole work, so that it now forms a practical guide and director to the assayer quite in accord with the progress of the art of assaying, setting forth such improvements important to the assayer as enable him to secure greater accuracy in his results, or to occupy less time in obtaining them. The general plan of the work, and the arrangement of the chapters, remain the same as in the third edition; but new matter has been added, whilst some of the chapters have been rewritten. Many processes and descriptions, which have been superseded by improved methods, have been omitted. Notwithstanding this, it has, it appears, been found necessary to add more than 100 pages to the volume. In Chapter IV., treating of the production and application of heat, much new information will be found respecting the employment of gas in the laboratory. In Chapter V. improved processes are given for the assay of coal before the blowpipe. Chapter VII., treating of the blowpipe and its use, is much altered; it contains a complete scheme for the discrimination of minerals, drawn up by Professor Thompson of Sydney, which cannot fail to be of the greatest value to mineral explorers. The other chapters, relating more especially to the different metals, contain the most recent and trustworthy processes for their determination, in addition to those in general use by assayers. After consultation with many practical men, it has, it seems, been deemed unadvisable to change the chemical equivalents and notation adopted in previous editions. Save this, the work has the aspect of an entirely new one.

A Mathematical Treatise on the Motion of Projectiles, founded chiefly on the Results of Experiments made with the Author's Chronograph. By Francis Bashforth, B.D. Asher and Co.

This is a valuable work on a subject of practical importance to all who take an interest in improving our war instruments, embodying the results of Prof. Bashforth's eight years' labours, so arranged as to be especially adapted for the instruction of the advanced class of Artillery officers, and contains the methods and tables for accurately calculating the trajectories of projectiles, the whole of the data for which has been derived from actual experiment with the clock chronograph. The mathematical investigations of Bernoulli, published a century and a half ago, has been thus rendered practically useful.

It may surprise many people to learn that no systematic series of experiments has yet been made, and the Professor recommends a series of experiments to be undertaken to determine, in a satisfactory manner, the law of perforation of iron plates by elongated shot, and advocates the use of guns with small bores of half to three inches, in connection with suitable thicknesses of iron plates, believing that the law of penetration would, in this way, be more accurately, and far more cheaply determined, than by the use of the large guns now in the service.

The Sewage Question and the Lime and Cement Process of Major-General H. Y. D. Scott, C.B. With the opinions of the many eminent Chemists, Engineers, and Agriculturists who have given testimony in favour of this process. London: Printed by Nissen, Parker and Arnold, 43, Mark-lane, for Scott's Sewage Company, Limited, 26, Great George-street, Westminster. 1873.

This pamphlet, advocating the claims of General Scott's cement making and sewage utilising inventions, is just now, when a loud outcry is being made against the use of liquid sewage as a manure for growing crops, worthy of careful perusal and earnest consideration. General Scott and his friends who constitute the company for carrying out his processes, though not entering into the wholesale condemnation of sewage irrigation, fully believe that some process of defecation should be resorted to before sewage is applied as manure, and the process they propose is to precipitate the solid matters and produce cement, and leave defecated liquid which will be a safe and harmless manure. The following extract will convey a tolerably correct notion of the *rationale* of the system advocated in this pamphlet:—

Now it is manifest that we have, in the deposit produced, both in the mineral matters removed from the sewage water and in the materials added to produce precipitation, substances analogous to the components of the limestones that are employed in the manufacture of hydraulic cements and limes. After calcination, the products are perfectly similiar, for all the organic matter has then been destroyed, the carbonic acid and water have been expelled, and nothing remains but lime and clay, together with some other substances, such as the alkalis, phosphates, &c., which are found in small quantities in all hydraulic limes and cements.

The discovery that hydraulic limes and cements resulted from the calcination of limestones containing clay, was first made by Smeaton, the celebrated engineer; and Vicat subsequently determined the proportion of clay which it was necessary that limestones should contain, in order to yield limes possessing in greater or less degree the property of setting in water. Vicat, indeed, established a factory at Meudon, near Paris, at which artificial limes were made by calcining mixtures of chalk (carbonate of lime) and clay in the proportions necessary to give the required results.

In this country, also, and abroad, the so-called Portland cement is made by calcining at a high temperature a mixture of 75 parts of chalk and 25 parts of clay. These ingredients are triturated in water and are then allowed to subside in tanks.

It will be readily seen that there must be a great similarity between the compound thus produced and that which results from introducing into a sewer quick-lime and clay, in the proper proportions for making cement or hydraulic lime, and then allowing precipitation (of the carbonate of lime formed, and of the clay) to take place in large settling tanks, such as are used in sewage works.

The chief points of difference, which are entirely in favour of the sewage process, are:—

1st. The more intimate mixture which can be brought about in the sewage water, owing to the impalpable nature of the precipitate of carbonate of lime which separates on the addition of the lime.

2nd. The more rapid settlement of the sewage precipitate than of the mixture of chalk and clay, owing to the presence of flocculent matter, which entangles the fine particles.

3rd. The presence of organic matters which are carried down from the sewage with the precipate, and which will serve for fuel to burn the mixture to lime or cement.

The amount of fuel, indeed, which the sludge will afford is so large, as we have already seen, that, in the absence of any better mode of getting rid of the deposit, and in consequence of the loss which results from attempting to deal with it as a manure, it has even been proposed to get rid of it by burning, without reference to any product which may contribute towards meeting the expense of the treatment.

The idea will occur to many—it is an objection to the process which is constantly raised—that the amount of cement produced would be more than the country can use.

This, however, is said to be an error. The quantity of inferior lime which is used in the greater part of the towns of England, and in the country around them, far exceeds the quantity of cement that could be produced in this manner.

It is to be borne in mind that the ultimate effect of the process would be simply to divert the inferior limes from the direct channel for a time, and, after using them for cleansing the sewage, to return them again to the building trade in a greatly improved form. The increase in the absolute quantity of mortar-making material will be such only as will be due to the cement-making elements which are gained from the sewage, and from the clay which may be added, and these, taken together, would rarely exceed the quantity of cement now used in manufacturing towns.

The process will, in fact, yield only from half-a-ton to three-fifths of a ton of cement per week, for every 1,000 inhabitants.

The question of re-placing such pure, and therefore inferior, limes as would be used for the precipitation process, by good hydraulic limes and cements, will be better appreciated by engineers and architects than by the general public. Nevertheless, there are few householders who do not find reason to complain of the softness of the plastering on the walls; and the amount of money expended in re-pointing brickwork is not unimportant.

Scientific Handicraft. A Descriptive Illustrated and Priced Catalogue of Apparatus suitable for the performance of Elementary Physics. By John Joseph Griffin, F.C.S. Vol. I. Mechanics, Hydrostatics, Hydrodynamics, and Pneumatics. London: John J. Griffin and Sons, 22, Garrick-street, W.C. 1873.

The contents of this very useful work is plainly indicated by its title as above stated. This plan of combining a trade catalogue of scientific instruments, with examples and experiments, partakes of a somewhat novel character, and doubtless the work will be well appreciated by those for whom it is specially intended. We consider it will more particularly be found serviceable to science teachers, to whom we commend its perusal. The way in which the various matters treated of are handled in this first volume gives us confidence that the other intended volumes will be found equally useful to all interested therein, and we trust the success of the present issue will be such as to enable the author to carry out his intentions as regards the other branches of practical science. However, the nature of the subjects dealt with in its pages renders it useless for us to make any quotations from the work, for they would be difficult to understand without the aid of the illustrative engravings referred to.

[Continuation of Reviews will be found on Page 163.]

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LORD RICHARD GROSVENOR, M.P.

Chairman of the Council:

SIR ANTONIO BRADY.

NOTICES.

TO MEMBERS OF COUNCIL.

A meeting of the Council will take place on October 16th, at 7 o'clock.

At the Office of "The Scientific and Literary Review, 21, Cockspur Street.

All Subscriptions should be paid to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W.

Proceedings of the Institute.

A meeting of the Council (ordinary and special) of the Inventors' Institute was held on the 4th of September, 1873, at the Office of the SCIENTIFIC AND LITERARY REVIEW, 21, Cockspur-street. Mr. A. J. Murray, Member of Council, presiding.

After the minutes of the last meeting had been read and confirmed as being correctly entered,

The Secretary informed the meeting that, as this was the first special Council meeting having a sufficient quorum of members which had met for some time past, it was competent, according to the rules, for that meeting to reconsider any resolutions passed at any ordinary Council meetings held in the interval that had occurred since the last duly constituted special Council meeting.

At the request of the Chairman, the Secretary recapitulated the business transacted at the ordinary Council meetings referred to; and the Chairman then asked if anyone had any motion to make thereon. Whereupon, no motion being made, he proceeded to take the next business, which was as to the arrangements which should be made in regard to the Institute being represented at the British Association meeting at Bradford.

Mr. Carttar moved that Mr. F. H. Varley and Mr. A. J. Murray be, and are hereby, specially requested to attend the Bradford meeting as hon. commissioners.

This was seconded by Mr. McLauchlan, and carried unanimously.

The Secretary was asked if he could go to Bradford, but stated that he feared he should be unable to do so.

Mr. Morgan then moved, "That the several members of the Institute residing, or being on business, at Bradford, especially S. C. Lister, Esq., be requested to attend the British Association, and act as representatives of the Institute."

This was seconded by Mr. McLauchlan, and carried unanimously.

The usual financial communications from the Treasury Committee were made to the Council, and the following gentlemen admitted as,—were ordered to be placed on the list of,—members, viz., Messrs. Louis Bourget, George Percival Spooner, Peter Thomason, Edward Newbold, John T. Sprague.

Monthly Notices.

At a recent general assembly of French papermakers, MM. Jourdenil, Parizot, and Gresse, the well-known firm of paper manufacturers, submitted some samples of the sheath of the hop stalk as a material for papermaking. By removing the outer skin and subjecting it to a certain chemical process, a textile substance, possessing the qualities which make rags so valuable in papermaking, namely, length, suppleness, and delicacy of texture, has been produced. The invention has been patented, and seems likely greatly to interest English hop-growers.

It is with much pleasure we announce that her Majesty has conferred the honour of Knighthood on the eminent Civil Engineer, John (now Sir John) Hawkshaw. This honour is a well-earned mark of recognition of the man, and a well-merited compliment to the Civil Engineering profession. It is a pity, however, that the Government could not see its way clear to making a batch of knights from amongst the great Civil Engineers of the day; and that instead of ordinary knighthood an order of merit should be instituted (say an expansion of the Order of the Bath), so that men who have won this position for themselves by worth and talent shall not be confounded with turtle-loving Aldermen, who have been lucky enough to play the lacquey to some semi-barbaric potentate or scion of royalty out for a holiday.

On the volatilization of metallic iron, the *Journal* of the Iron and Steel Institute reports that Dr. Elsner, of the Royal Porcelain Manufactory at Dresden, placed a piece of wrought iron in a closed crucible of unglazed porcelain, and exposed it for several hours to a temperature of fully 3,000 deg. in a kiln. On examining the crucible when cold, it was found that the iron had been volatilized and condensed on the under surface of the crucible-lid in small needle-shaped crystals.

The *Phylloxera*, so injurious to vines, it is stated by M. Faucon, may be destroyed by prolonged submersion of the vines under water. He, therefore, suggests that the vineyards should be flooded in the autumn or in the winter: official experiments on this subject are to be carried out during the coming season.

A bone cavern, presenting traces of human occupation, has it is stated, been discovered in Silurian rocks on the coast southwest of the Bay of Kirkcudbright. The stalagmitic breccia and the cave-earth have yielded numerous bones of animals,—including those of the ox, red-deer, goat, horse, pig, and several rodents,—together with fragments of bronze and objects in bone, evidently of human workmanship. The exploration of this seemingly interesting cave is in the hands of Mr. A. J. Corrie and Mr. W. Bruce-Clarke.

M. Nordenskiold, writing from Mossel Bay (lat. 79 deg. 54 min. N.), states that the vegetation of Algæ attains a maximum in the darkness and cold of an arctic winter. A highly sensitive photographic plate kept for twelve hours at the bottom of the sea, where Algæ flourished, was raised unchanged, the temperature being 2 deg. Cent. In the same letter he states, that Dr. Wykander and Lieutenant Parent had studied the aurora with much care by the aid of the spectroscope. The indications appeared to favour the idea that the phenomena were related to the fall of fine particles of iron and carbon, the presence of hydrogen, and probably of snow. The *Comte Rendus* for the 21st of July, in which this letter is printed, gives a communication from Father Secchi, "On the Spectra of Iron and other Metals." He is led, from his researches, to doubt if the line seen in the corona of eclipses, which has been considered to indicate iron, does really do so. He concludes that, if it belongs to iron, it is developed under unknown conditions of temperature.

Under the name of *Drepanornis Albertisi*, Dr. Sclater, of the Zoological Society, has lately described a new Bird of Paradise, which was discovered a short time ago by Signor Luigi Maria D'Albertis, at Atam, in the Arfak Mountains of New Guinea.

One of the most curious questions of botanical geography is that of the transport of seeds across seas by means of currents, winds, ice, and other agents. At the instance of the eminent botanist, M. A. De Candolle, some experiments on this subject have been made by M. Thurat, who lives at Antibes, on the French shore of the Mediterranean. The results of these experiments, which were made to determine the relative durability of different kinds of seeds when kept in sea-water, are published in the *Bibliothèque Universelle et Revue Suisse*, and are interesting for comparison with the kindred experiments of Darwin and Charles Martins.

The supply of lithographic stone from Germany has been gradually falling off—hence it is important to notice the discovery of two sources of supply in Italy, one near the French frontier and the other on the coast of the Gulf of Genoa. It is said that the stones are of superior quality.

The *Bulletin de la Société Chimiquè de Paris*, amongst many chemical papers of much interest, draws some attention to a waterproof glue, which promises to be of considerable value. The action of light in rendering the size on paper, when it is coated with the bichromate of potassa, insoluble was first noticed by Mr. Mongo Ponton, and the principle has been applied to several of the photographic printing processes. Gum, glue or gelatine may thus be rendered insoluble, and the action takes place, though slowly, in the dark. A concentrated solution of the bichromate of potassa is kept in the dark, and some of it is added to boiled gelatine. Anything glued with this may, after a little time, be washed with hot water without effect. A parchment paper, used largely for wrapping the pea-sausages of the German soldier, is prepared by M. J. Stinde with this chromatized gelatine.

The French Photographic Society informs us in its Bulletin that M. Despaquis has prepared some very pleasing photographs with the Bitumen of Judea which was, it will be remembered, the material used by M. Nicephore Niepce, more than half a century since, before his connection with Daguerre.

In Dr. Quesneville's *Moniteur Scientifique* for August, is a report presented to the Industrial Society of Mulhouse, by M. Fr. Goppelsrœder, "On the Regeneration and Restoration of Oil Paintings by Pettenkofer's Method." This report, which examines into the physical and chemical changes which take place in paintings, and gives experiments on the means employed by Pettenkofer for the revival of colour and the like, is worthy of every attention.

The Commissioners "to make inquiry with regard to scientific instruction and the advancement of science" have issued their third report. It recommends no radical changes such as are really needed, and concludes with this statement:—"We have endeavoured to indicate what, in our judgment, should be the general direction of such changes, and we have not altogether abstained from offering suggestions as to particular modifications or improvements of existing arrangements; but we are sensible that questions of detail are likely to be best discussed in the Universities themselves, where they will come under the consideration of persons who have made the theory and practice of education the business of their lives, and whose judgment on all points connected with the working of their own system ought to carry great weight."

On the 21st of August the French Association for the Advancement of Science commenced its meeting at Lyons, under the presidency of M. de Quatrefages, who chose for the subject of his inaugural address, "Le Siecle de la Science, l'Enseignement Scientifique." Dr. Carl Vogt was present, and that eminent *savant*, whose protest against the annexation of Alsace and Lorraine has endeared him to the French, was warmly received. The sittings terminated on the 28th, and on Friday several members of the association paid a visit to Geneva, where they met with a cordial reception.

Asphalte paper, or more correctly, paper coated with asphalte, is again claiming some attention. It is strongly recommended for lining boxes and cases, which are to receive goods requiring protection from the damp. It is also "rolled up into pipes for conveying water." In 1862 water-pipes thus manufactured were exhibited, and from their lightness and supposed durability, some experiments were made with them, especially in mines, where the water speedily corroded the iron. At Polberro Tin Mine, in Cornwall, they were introduced; but were soon abandoned, as they failed entirely to resist the pressure of the water in the pumps.

The third annual report of the deputy-master of the Mint has been recently issued. It gives some good examples of the value of the applications of science to the processes of coining. The value of the spectroscope to quantitative analysis, especially in the gold-parting assay, is proved by Mr. Roberts to be great. Traces of gold have been found in the worn-out silver coinage; 81·27 oz. of gold have been recovered from 117,048 oz. of old crowns and half-crowns.

The report of the Meteorological Committee of the Royal Society for the year 1872 is before us. It is not possible to discuss the question of the value of the system of meteorological observations as carried out under the direction of this Committee. But while we most fully admit the importance of the land meteorology of the British isles, and the real advantages of weather telegraphy and signals, we doubt whether the information received by the committee on ocean meteorology—notwithstanding their statement that it "comprises the investigation of the meteorological conditions of the entire ocean,"—is worth the £2,000 it costs, seeing that observations were made in ninety-three ships only, and that the statement of the localities whence observations were derived shows that very vast tracts of the ocean were unobserved.

Potasso-gypsite, a beautifully crystallized double sulphate of calcium and potassium, discovered some years since by Mr. J. A. Phillips, as an incrustation on a boiler employed for the evaporation of sulphate of potassium, has been recently found as a mineral, associated with rock-salt, at Kalusz. Dr. F. Ulrich, who has examined both the natural and the artificial crystals, finds, however, that they belong to the monochinic and not to the rhombohedral system, as announced by Prof. W. H. Miller; this error is explained by the fact that the crystals of potasso-gypsite are twins.

Prof. Morton has communicated to the *Chemical News* an important "Investigation of the Fluorescent and Absorption Spectra of the Uranium Salts," by himself and Dr. H. Carrington, Bolton.

During an unusually heavy snow-storm in Stockholm, which continued for five or six days, in December, 1871, Nordenskjold detected, even in those portions of the snow which fell latest, a black carbonaceous powder, charged with very small spangles of metallic iron. He has since found similar substances in the snows of the Arctic Regions and from the heart of Finland. It will be curious to learn from the analysis, which he has recently promised, whether the iron in this cosmical dust is similar to meteoric iron.

L'Abbé Moigno, in *Les Mondes* for September 4, publishes some curious remarks on "La Vision et les Animaux Mystérieux d'Ezéchiel," by M. l'Abbé Darras, who has recently published his "Histoire Générale de l'Eglise, depuis la Création jusqu'à nos Jours."

Kjerulfine is the name of a new mineral species, described by Von Kobell. It is a phosphate of magnesia and fluoride of calcium, occurring at Bamle, in Norway, and is named in compliment to the Norwegian geologist, Kjerulf.

In the *Annals and Magazine of Natural History*, for August, Dr. H. A. Nicholson describes several new species of Stromatopora, from the Silurian and Devonian formations of Western Canada. Stromatopora is so singular a genus that its affinities are very obscure. Some of the new species, however, exhibit certain points of relationship to the Spongidæ, which have not hitherto been recorded, and tend to strengthen the view which refers Stromatopora to the family of Sponges.

The recent wet weather has seriously interfered with harvest operations in the late districts of the West of England and Wales. In a precarious climate like ours it is not surprising that the farmer grumbles so much. He would be happy if his calling allowed him to be as heedless of barometrical and thermometrical changes as most other people. Any discovery that would make him less dependent on cold and rain, wind and drought, would be a great boon. How to harvest crops in wet weather is a question the solution of which has long gained the attention of practical men, and five years ago the Society of Arts awarded a prize of 50 guineas and a gold medal for the best essay on the subject. The successful writer was Mr. W. A. Gibbs, Gillwell Park, Essex. His system is to dry sheaves of corn by drawing a hot blast of air through them at 320 deg. Fahrenheit, by means of a fan with a speed of 600 revolutions per minute. By this means a small three-horse power steam-engine can be made to thoroughly dry thirty-two sheaves of wet corn in fifteen minutes, at a cost of about 1s. per quarter of threshed corn. The device, to which the *Chamber of Agriculture Journal* has drawn renewed attention, is well worth the attention of farmers.

NEW PLANETS.—The three small planets discovered in France last year have received the names Liberatrix (in honour of M. Thiers), Vellida, and Johanna. The five planets which still remain without names were all discovered by Prof. Watson, of Ann Arbor, Michigan, U.S., three last year and two this.

FRESHWATER FISH.—A collection of freshwater fishes, made at Shanghai by H.M. Consul, Mr. R. Swinhoe, has been reported on by Dr. A. Günther, of the British Museum. The collection is notable for containing an unusually large proportion of new species, or such as have hitherto been but imperfectly known.

TRIBUNALS OF COMMERCE.—A meeting was called by Mr. Lyne, at the London Tavern, on this subject, on the 18th inst. It was not, as Mr. J. R. Taylor, the Hon. Secretary, informs us, a meeting of the Tribunals of Commerce Association, of which Mr. F. W. Campin is a Member. Mr. Lyne, it is said, signified his intention to relinquish office.

General Literature.

The Sea and its Living Wonders. A Popular Account of the Marvels of the Deep, and of the Progress of Maritime Discovery, from the Earliest Ages to the Present Time. By Dr. G. HARTWIG, author of "The Tropical World," &c. Fourth edition, enlarged and improved, with numerous wood cuts and chromoxylographic plates. London: Longmans, Green, and Co. 1873.

THIS is a new edition of a truly pleasant and withal highly scientific work, so thoroughly scientific indeed, that although we have placed it under the head of "General Literature," we have done so not because it would not more appropriately have been placed amongst the scientific works, but simply in order that our readers may at once know that amusement is to be obtained from its pages in even a higher degree, if possible, than scientific instruction, though this they will find to be of a very high order, for *dulce et utile* is the true character of the book, as every reader will readily admit.

In this fourth edition the same general character is preserved as that of other editions. "The Physical Geography of the Sea," "The Inhabitants of the Sea," and "The Progress of Maritime Discovery" being the three parts constituting the work; but two new chapters—one on "Marine Constructions," the other on "Marine Caves"—have been added; those on the "Molluscs and Cœlenterata (Jelly-fishes, Polyps)" almost entirely re-written; and those on "Fishes," "Crustaceans," "Microscopic Animals," "The Geographical Distribution of Marine Life," and "The Phosphorescence of the Sea," considerably enlarged; not to mention a number of minor improvements dispersed throughout the volume.

Great attention has also been paid to the illustrations, many of very small value having been omitted in the present edition, to make room for a number of others, which will be found of great use for the better understanding of the text.

Indeed, we may fairly affirm the statement Dr. Hartwig makes in his preface when he says he has done his best to raise the work to the standard of the actual state of science, and to render it a complete epitome of all that the general reader cares to know about the marvels of the deep.

How well Dr. Hartwig has succeeded, the reader may judge from the following extracts:—

The first of these is from the new chapter on Marine Constructions, and shows that to the man of practical science and the inventor, the aphorism applied to the poet, *Nascitur non fit*, may often be with truth appropriated. In briefly recounting the history of Eddystone Lighthouse, Dr. Hartwig says, "Strange to say, the task of rebuilding the Eddystone Lighthouse—to supply the place of that erected in 1696, by Winstanley, which was destroyed in the dreadful hurricane storm in November, 1703—once more devolved, not upon a professed architect—Winstanley being a country gentleman—but upon a Mr. Rudyerd, a linendraper of Ludgate-hill, the son of a Cornishman, who had raised himself by his talents and industry from a very low social position to a station of honourable competence. The choice, however, was not ill-made, for with the assistance of two competent shipwrights, the London tradesman constructed an edifice which, though mainly of timber, was so firmly bolted to the rock with iron branches, that for nearly half a century it resisted the fury of the billows, and might have withstood them for many a year to come, had it not been rapidly and completely destroyed by fire. This catastrophe, which happened on December 2nd, 1755, was marked by a strange accident, for whilst one of the lightkeepers was engaged in throwing up water four yards higher than himself, a quantity of lead, dissolved by the heat of the flames, suddenly rushed like a torrent from the roof, and falling upon his head, face and shoulders, burnt him in a dreadful manner. Having been conveyed to the hospital at Plymouth, he invariably told the surgeon who attended him that he had swallowed part of the lead while looking upwards; the reality of the assertion seemed quite incredible, for who could suppose it possible that any human being should exist after receiving melted lead into the stomach? much less that he should afterwards be able to bear the hardships and inconvenience from the length of time he was in getting on shore before any remedies could be applied. On the twelfth day, however, the man died, and having been opened, a solid piece of lead, which weighed about seven ounces, was found in his stomach. The structure thus destroyed was, as all the world knows, succeeded by that now standing, erected under the direction of Smeaton, the justly celebrated engineer."

The following, which has reference to that remarkable marine animal, the *Octopus*, and his analogues, taken from the chapter on Molluscs, may interest many of our readers:—

All the Cephalopods—one of the orders of Molluscs (says Dr. Hartwig), are marine animals, and breathe through branchiæ or gills. These are concealed under the mantle in a cave or hollow, which alternately expands and contracts, and communicates by two openings with the outer world. The one in form of a slit serves to receive the water; the other, which is tubular, is used for its expulsion.

According to the different number of their gills the octopods are divided into two groups. The first, to which the poulp and cuttle fish belong, and which comprises by far the majority of living species, has only two sets of gills, while the second, which, in the present epoch, is only represented by a few species of nautilus, has four, two on each side, according to the number of arms or feet—for these remarkable organs serve equally well for prehension or locomotion. The first group is again sub-divided into two orders, octopods and decapods, the former having only eight sessile feet, while the latter possess an additional pair of elongated tentacles, which serve to seize a prey which may be beyond the reach of the ordinary feet, and also to act as anchors to moor them in safely during the agitations of a stormy sea.

It appears that the cephalopods are extremely voracious, and would soon produce a fish famine by killing the young fish and naked molluscs, such as the oyster, but that they are themselves *chawed up*, as the Yankees have it, by the sperm whale, the albatross, and petrels, who love to skim them from the surface of the ocean, and man catches many millions to serve as bait for valuable fish—cod, for instance.

At Teneriffe, in the Brazils, in Peru and Chili, in India and China, various species of cephalopods are used as food. Along the eastern shores of the Mediterranean, the common sepia constitutes now, as in ancient times, a valuable part of the food of the poor. "One of the most striking spectacles," says Edward Forbes, "is to see at night on the shores of the Agean the numerous torches glancing along the shores, and reflected by the still and clear sea, borne by poor fishermen paddling as silently as possible over the rocky shallows in search of the cuttle fish, which, when seen lying beneath the water in search for his prey, they dexterously spear ere the creature has time to dart with the rapidity of an arrow from the weapon about to transfix its soft but firm body."

The eggs of the litoral cephalopods appear in the form of dark-coloured spindle-shaped bodies of the size and colour of grapes, and hang together in clusters, and are termed by the fishermen sea-grapes.

The Paradise of Birds. An old Extravaganza in a Modern Dress. By WILLIAM JOHN COURTHOPE, Author of "Ludibria Lunæ." Second Edition. William Blackwood and Sons, Edinburgh and London. 1873.

THIS is a little poem suited for those who enjoy having a fling at the philosophic priggisms and scepticisms of the age they live in. The author is playing the mentor in holiday garb, and those who are holiday-making will find that a dip into this booklet will be no pleasure-spoiling affair, but will serve to give zest to recreation.

It would be difficult to afford any connected idea of the character and contents of this work (other than that it is *à la* Aristophanes) in any briefer way than the author himself does by the work itself. Perhaps, however, the enumeration of the *dramatis personæ* may throw some light on the matter. These are

MARESNEST, a Philosopher of the "Development" Persuasion.
WINDBAG, a Poet of the Romantic School.
BIRDCATCHER,
COOK, } Souls in Purgatory.
LADY,
ROC, an extinct Bird in his Egg-Shell, the Gate of Limbo.
BIRD OF PARADISE, King of the Birds' Paradise.
JACKDAW,
ROOK,
PIGEON,
LARK,
NIGHTINGALE,
GOLDFINCH, } Birds in Paradise.
BLACKBIRD,
THRUSH,
LINNET,
SWALLOW,
GOOSE,
CHORUS OF HUMAN BEINGS IN PURGATORY.
CHORUS OF EXTINCT BIRDS IN THE SHELL.
CHORUS OF BIRDS IN PARADISE.
A JURY OF TWELVE BIRDS.

The prologue, spoken by Nightingale, will also aid in explaining the nature and contents of the work:—

Kind gentlemen, and ladies dear,
To a poor nightingale give ear.
The poet bids me fly to you,
His audience fit (since doubtless few),
And introduce my bill of fare
For the entertainment we prepare.
If then you choose to taste the same,
And feel disgust—we're free from blame.
And first I say that, by your grace,
We mean to represent a place
To human sailors (save alone
To Fancy and her crew) unknown;
Not yet subjected to the reign
Of Science, tyrant and profane,—
The would-be queen, and upstart thief,
Who steals the lands of old Belief—
But unexplored (thank Heaven!) and free
To Wonder and to Poetry.

Strange things in this strange place you'll view;
Conclude not therefore they're untrue.
Fancy of all things takes precedence
In travel,—so she should in credence;
For once 'twas fashion to traduce,
But now you all believe in, Bruce.
Besides, in this our moral age,
Bards have so serious grown and sage,
(Not to say dull), and all, forsooth,
Are so well paid for preaching Truth,
You might as soon suspect pretension
In priests, as poets of Invention.

Know, too, beforehand, that we birds
Shall speak with men in human words.
If such a prodigy displease,
Quarrel with Aristophanes;
Despise the light good-natured age
That clapped "the Birds" upon the stage;
And yet what pleased the Athenian state,
England, methinks, might tolerate.

Critics, fastidious and select,
Hear what from me you must expect.
If you my friend and poet praise,
You shall be happy all your days.
I will come flying in the moon,
And sing to you each night in June;
Restore the freshness to your brain,
When you have many authors slain,
And bring of epigrams a store,
That you may slay as many more.

But if this play you shall abuse,
Expect from all the feathered crews
Dire retribution. I will rouse
Vast twittering armies in the boughs;
(Nor deem your persons will to us
Be sacred, since anonymous)
Then, if your Sunday clothes you wear,
And walk abroad to take the air,
To preach or visit, dine or wed,—
Keep an umbrella overhead.

The following is a pleasing fling at the philosophers:—

MARESNEST.

The rise of Species: can it be
You know not how it was? Then hear from me.
Ho! ye obsolete wings in the outset of things,
Which the clergy Creation miscall,
There was nought to perplex by shape, species, or sex;
Indeed, there was nothing at all,
But a motion most comic of dust-motes atomic,
A chaos of decimal fractions,
Of which each under Fate was impelled to his mate
By Love or the law of Attractions.
So jarred the old world, in blind particles hurled,
And Love was the first to attune it,
Yet not by prevision, but simple collision—
And this was the cause of the Unit.
That such was the feat, which evolved light and heat,
A thousand analogies hint;
For instance, the spark from the hoof in the dark,
Or the striking of tinder and flint.
Of the worlds thus begun the first was the Sun,
Who, wishing to round off his girth,
Began to perspire with great circles of fire—
And this was the cause of the Earth.
Soon desiring to pair, Fire, Water, Earth, Air,
To monogamous custom unused,
All joined by collusion in fortunate fusion,
And so the Sponge-puzzle produced.
Now the Sponge had of yore many attributes more
Than the power to imbibe or expunge,
And his leisure beguiled with the hope of a child.

CHORUS.

O philoprogenitive Sponge!

MARESNEST.

Then Him let us call the first Parent of all,
Though the clergy desire to hoodwink us;
For He gave to the Earth the first animal birth,
And conceived the Ornithorhyncus.

CHORUS.

Conceived the Ornithorhyncus!

MARESNEST.

Yes: who, as you have heard, has a bill like a bird,
But hair and four legs like a beast,
And possessed in his kind a more provident mind
Than you'd e'er have presumed from the priest:
For he saw in the distance the strife for existence,
That must his grandchildren betide,
And resolved, as he could, for their ultimate good,
A remedy sure to provide.
With that, to prepare each descendant and heir
For a different diet and clime,
He laid, as a test, four eggs in his nest—
But he only laid two at a time.
On the first he sat still, and kept using his bill,
That the head in his chicks might prevail.
Ere he hatched the next young, head downwards he slung
From the branches, to lengthen his tail.
Conceive how he watched till his chickens were hatched,
With what joy he observed that each brood
Were unlike at the start, had their dwellings apart,
And distinct adaptations for food.
Thereafter each section by Nature's selection
Proceeded to husband and wive,
And the truth can't be blinked that the weak grew extinct,
While the lusty continued to thrive.
Eggs were laid as before, but each time more and more
Varieties struggled and bred,
Till one end of the scale dropped its ancestor's tail,
And the other got rid of his head.
From the bill, in brief words, were developed the birds,
Unless our tame pigeons and ducks lie:
From the tail and hind legs, in the second-laid eggs,
The Apes and—Professor Huxley.

CHORUS.

The Apes, and Professor Huxley!

MARESNEST.

Yes; one Protoplasm, connecting the chasm
'Twixt Mammal, and Reptile, and Roc,
With millions of dozens of fungus first cousins,
Reduces the world to one stock;
And though man has a place from the Sponge at the base
In variety farthest removed,
And has managed to reach what he calls soul and speech,
Yet his blood is by language approved.
For instance, the tribe that contrives to imbibe,
While the friends, who believe in them, plunge
Their hands with mad pranks into Railways and Banks,
We term the variety Sponge.
And perhaps like our Sire, as all classes mount higher,
We shall merge into Oneness again,
Our species absorb all the rest in its orb,
And Birds, Beasts, and Fishes be Men.

Reviews of the following works are unavoidably postponed till next number:—

"Quantitative Chemical Analysis." By T. E. Thorpe, Ph.D., F.R.S.E. Messrs. Longmans.

"Sewage Utilization." By U. R. Burke, M.A. Messrs. E. and F. N. Spon.

"Natural History for Beginners." By H. Alleyne Nicholson, M.D., D.Sc., M.A., Ph.D., &c., &c. William Blackwood and Sons.

"A Scamper Across Europe." By T. L. Nichols, M.D. Messrs. Longmans, Green, and Co.

"Count Rumford—How he Banished Beggary from Bavaria." By T. L. Nichols, M.D. Messrs. Longmans, Green, and Co.

"Rays of Light." By F. Ayckbourn.

"Story of the Earth and Man." Hodder and Stoughton.

"The Story of a Life." By W. A. Gibbs, Esq. In the quotation given at page 143, at line eleven, for the word "as," read "at," the one word being substituted for the other by *our* typographical error.

The Writing-ball ; or ,Electric Type-writing Apparatus.—Invented by Rev. R. Malling Hansen, Head-master of the Royal Institute for Deaf and Dumb, at Copenhagen.—This is a highly scientific and most ingenious instrument, and we intend to lay full details before our readers; want of space preventing our doing this in our present number. In the meantime, those who seek to know more on this subject, can apply to Messrs. Holten and Co., 82, Gracechurch-street, London, E.C.

Patent Law Meetings at Bradford.—Want of space compels us to defer the report on this subject till our next. We may mention that the representative of the Inventors' Institute, S. C. Lister, Esq., a well-known manufacturer of Bradford, was voted to the chair. We may also mention, that on the subject of compulsory licenses, there seemed to be some difficulty in arriving at a conclusion.

The Lost Canon of Berosus.—Mr. George Smith has just discovered the fragments of an ancient Assyrian canon, from the Babylonian copy of which the much-contested canon of Berosus was unquestionably derived. The importance of this relic to chronologists can scarcely be over-estimated, and it will form the substance of a paper shortly to be read before the Society of Biblical Archæology by its fortunate discoverer.

Heat in Gas.—Amongst the many important industrial papers recently brought before the Iron and Steel Institute, there was one of great scientific interest, to which we desire to call attention. It was "The Rationale of the Combustion of Gases considered in relation to an increased supply of Heat," by M. Charles Boutmy, of the Ecole de Liége. This communication has a most important bearing on the utilization of the gases of blast-furnaces.

DEATH OF AN OLD INVENTOR.

By the decease of Henry Richardson Fanshawe there has just passed away from amongst us, at the age of 62 (our inventor's age), a practical worker to whom some comparatively new and important branches of industry owe not a little of their successful development. He was the son of a silk manufacturer in Spitalfields, and he and his brother, John Americus Fanshawe. early in life devoted their attention to the manufacture of vulcanized India-rubber. The history of Silvertown is, to a certain extent, their history, for they, for some years, applied their energies to the carrying out of the important rubber works there. On leaving that place John Americus became identified with the well-known firm of George Warne and Co., of Tottenham, where, in connection with his partners, he produced some most valuable improvements in rubber manufacture, while Henry R. Fanshawe took a wider field. John's steady adherence to the one subject provided him with comfortable competency, while Henry's inventive powers were so fertile that his time was occupied in inventing, and little could be devoted to their commercial development. The consequence was that although he assisted materially in building up the fortunes of others, he himself remained poor through the greater part of his career. Amongst other inventions he brought out an expeditious mode of tanning by the aid of improved machinery and process, some most important improvements in the manufacture of kamptulicon, and an exceedingly ingenious diaphragm for casks, by means of which the freshness of the liquor contained is retained to the last drop. He also devised a well-considered plan of lighting mines with gas, the gas being, as it were, isolated from the mines, and supplied with air from without by means of tubes, a second set of tubes carrying away the hot air to the surface. Amongst other things was a plan for catching fish by means of a submerged light. This, at the time, attracted much attention. A paper was read on this subject by the Society of Arts by Mr. F. W. Campin, the patent barrister, and the invention was carried out practically off Great Grimsby in the *Mary Hewitt* fishing smack. The "takes" proved its success, and after the first demonstration the old hands in the other smacks fished in a circle round the light-ship. The diffusion of light was attended by a corresponding diffusion of luck. The larger, finer fish came boldly up towards the lamp, and eagerly took the bait. Thus the *Mary Hewitt* got the bigger fish, but all the smacks got unprecedented "takes." Notwithstanding this success, sufficient capital was not found to carry out the plan on a large scale, and Henry Fanshawe sustained a severe disappointment. More recently Mr. Fanshawe brought out a most important invention for waterproofing, indurating, and otherwise improving the condition of leather. At the outbreak of the Franco-Prussian war, large contracts were secured for the supply of boots to both armies, and poor Fanshawe's star seemed to be in the ascendent. With the close of the war, however, the orders ceased, the boot and shoe manufacturers finding that there was, for profit, "nothing like leather" that had not been proofed, as the increase of durability led to a decrease in sales. This invention has been most successfully applied for boot soles and uppers, mill bands, and hose piping. The inferior portions of the hide are made equal to the best, and will fetch the same price, while low-classed butts (such as hemlock and *mimosa tamages*) will, when treated by this process, bear favourable comparison with the best English. Notwithstanding its merits, this invention has, from the want of sufficient capital to bring it prominently forward, been, from the commercial point of view, but partially successful, and poor Fanshawe has passed away at no great remove from absolute poverty, leaving behind him a family of five daughters, for whom he was unable to make any provision. Mr. H. R. Fanshawe was in person, whilst in health, the ideal of an Englishman, above the middle height, with large, well-set frame, of open, pleasing countenance, and with kindly-looking blue eyes. He had few, if any, enemies, but from his retiring, unassuming manner, his many friends were unable to render him that assistance which they would gladly have done. Mr. Fanshawe's remains were interred at Bow Cemetry, on the 22nd July. He has left behind him, in the hands of a friend, some highly-valuable inventions, which, but for the heavy fines upon inventive talent imposed by our Patent Laws, would long ere this have been brought out, and might have enabled him to have ended his days in much more comfortable circumstances. Mr. J. A. Fanshawe, of Tottenham, died about two years since.

Correspondence.

"CHEMISTIANITY."

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—I have much pleasure in informing you that the whole of the work "Chemistianity," now finally revised and reset up in type from the printer's proof book, has been in type some days, and that my printers, Messrs Chas. Willmer and Sons, at 1, Cooper's-row, Liverpool, and of Chester-street, Birkenhead, have this day printed off 2,020 (for 2,000) copies of the first portion of the work, and the remainder will be printed off by about Tuesday or Wednesday of next week, the printing on good paper for books requires four or five weeks to dry. I may safely state on or about the 15th day of October next, as the date of issue.

I deeply regret the length of time I have occupied to complete to my satisfaction my self-imposed task. The causes were my perseverance to make each line correct for chemical truth, and as near as possible for verse, and also a considerable delay in obtaining the proof book back from further correction by different chemical friends. Messrs. Stevenson, Blake and Co., of Sheffield, have supplied the whole of the perfectly new type purposely for my book. I have had the paper made specially, and watermarked, "Chemistianity." The whole work is got up in really first-class style, with my best aim for good sense, and will cost me, for the first edition, quite the sum I named—viz., £419.—Yours faithfully,

C. SELLARS, F.C.S., Gas Cement
works, Birkenhead.
Office, 2, Woodside Ferry-buildings,
Birkenhead.
Monday, August 25th, 1873.

APPLICATIONS FOR PATENTS.

(Continued from Page 154.)

and machinery and appliances therefor, part of which machinery is applicable to the preparation and drying of peat for fuel.—B. Hunt. Processes for the preservation of food (com.)—W. Clark. Apparatus for utilizing wave power for propelling vessels and other purposes (com.) (Complete specification.)—F. P. Girard. Presses for compressing artificial fuel and other analogous materials into blocks.—W. J. Coleman. Compositions for preserving meat, vegetables, fruit, and other articles of food.—W. Gardner and H. Jennings. Door knobs and spindles.—J. Lewis. Machine for cleaning, blacking, and polishing boots and shoes.—J. Mathieson. Construction of and the mode of firing torpedoes.—R. J. Markham. Wheels.

On July 31st.—2590 to 2600.—C. J. L. Leffler. Apparatus or machinery to be employed in rolling metals.—J. R. Whitgreave. Construction of ships and other vessels and boats.—J. Beckett. System of albumenizing paper.—P. Richards, H. H. Mott, C. F. Mott, and J. Howes. Appliances for raising and lowering window blinds, partly applicable to other raising and lowering purposes.—F. Hurd and E. T. Simpson. Mode of generating steam and expanding gases combined for motive power, also devaporising steam, and the machinery or apparatus employed therein.—E. T. Hughes. Door calls or bells (com.)—S. Shaw, J. S. Sleath, and J. Holt. Machinery for preparing wool or other fibrous substances for combing or spinning.—U. C. Hill. Cellulated bell pianoforte.—F. Barnett. Method of preparing asphalte for paving.—L. Seegers. Apparatus for a gas economiser; an apparatus for increasing the illuminating and heating powers of coal gas with reduced consumption.—G. Haseltine. Preparation and packing of water colours for artists and other purposes (com.) (Complete specification).

On August 1st.—2601 to 2613.—A. Deininger. Production from all vegetable matter containing a fibrous rind (bast-fibre), such as flax, hemp, nettle, &c., of a filamentous matter, which can be used as a filament for spinning, the process doing away with the retting process hitherto in use.—E. Casper. Apparatus for supplying water to steam boilers and other vessels, and water purifying apparatus to be used in connection therewith or otherwise (com.)—R. P. Spice and F. W. Hartley. Carburettors.—T. Cobbett. Ball joints.—R. W. Brownhill. Weighing machines for weighing railway trucks, road waggons, and similar purposes, as well as being particularly adapted for weighing coal trucks, minerals, and other colliery purposes and general merchandise.—W. H. Bonnewell. Apparatus for exhibiting advertisements, also applicable to other purposes.—W. Hale. War rocket apparatus.—A. A. Croll and D. C. Dalgairns. Treatment of sulphur ores.—G. C. Lilley. Cocks or taps.—O. Ball and E. Jowett. Jacquard engines.—W. Betts. Apparatus for ornamenting in colours the sides of metallic capsules.—J. Sibert. Apparatus for heating water for generating steam.—J. G. Cameron and J. Hastie. Steering apparatus.

On August 2nd.—2614 to 2622.—J. S. Crossland. Steam boilers.—J. Tillot. Apparatus for drying steam, or for separating water from steam.—A. Sonnenschein. School desks and appliances connected therewith.—N. D. G. Galland. Permanent ways of railways with heavy gradients. and improved rolling stock in connection therewith.—F. A. Palmer. Electro-magnetic engines (com.) (Complete specification.)—R. Chambers. Machinery or apparatus for cleaning wheat and other grain.—W. Clark. Construction of metallic and other chairs or seats, part of said improvements being applicable for other uses (com.)—E. P. Jones. Ties for securing bales of cotton and other merchandise.—J. B. Walker. Improved fuel.

On August 4th.—2623 to 2624.—E. J. Palmer, jun. Ventilating hats.—G. Rydill. Steam boilers and apparatus for utilising waste heat from boiler furnaces on land and sea, and improvements in furnace doors and hot-air tube, also to utilise the heat in the flues and chimneys, and for other purposes.

On August 5th.—2625 to 2631.—P. J. Livesey. Improved dovetailed joint, and mode or machinery for drawing the same, applicable for constructing drawers, cabinet work, and other purposes (com.)—W. Sandiford. Coupling tin rollers of mules for spinning.—T. W. Dunn and O. Prangley. Extracting animal grease and other impurities from wool. T. Shell. Motive-power engine.—J. L. Clark. Apparatus for recording the number of passengers conveyed in public vehicles, and the distance each has travelled.—J. H. Cohrs. Pistons which work without friction, and keep perfectly air-tight.—E. la P. Daniells. Improved article of dress.

On August 6th.—2632 to 2644.—J. Walker. Apparatus for lighting cigars and tobacco.—S. Long. Fittings of ships' boats, whereby they are rendered self-detaching when lowered into the water.—W. S. Crondace. Night-sight vane for small arms, also applicable to ordnance.—T. L. Phipps. Clippers for clipping horses and other animals.—J. Kirkman. Lubricating packing for the stuffing-boxes of steam engine piston rods, and for other similar joints requiring to be steam, air, or water tight.—T. J. Watson and A. Pegler. Packing for the stuffing-boxes of steam engines, and for other joints requiring to be steam, air, or water tight.—J. Leigh. Manufacture of manure.—S. S. Pollock. Appliance for checking and stopping frightened and runaway horses instantaneously without inflicting any injury on the animal in so doing.—P. R. de F. d'Humy. Means employed for stopping bottles and other similar receptacles.—G. T. Bousfield. Sewing mechanism for sewing machines (com.) (Complete specification.)—W. E. Newton. Machinery for moulding bricks, blocks, or other analogous articles composed of plastic or other substances (com.)—E. D. Johnson. Preserving steel pens.—W. Clark. Propulsion of vessels and apparatus for the same (com.)

THE EDUCATION OF THE HAND.—The almost marvellous power that may be given to the human hand by training it to the performance of a particular kind of duty has frequently been mentioned in advocating the extension of technical education, and we had a wonderful confirmation of this view at M. Rivière's Promenade Concerts, in the performance on the pianoforte of Mdlle. Marie Secretain. As this young lady has the honour of holding the first prize from the Conservatory of Music at Paris, no further evidence need be sought of her having undergone severe training, or of that training having well-developed her natural powers; yet, one cannot listen to her performance without being astonished at the wonderful power which she possesses over the instrument. The pieces to which we particularly refer are, a powerful solo —"Faust"—of her own composition, and introducing most brilliant variations upon several of the more popular airs in Gounod's opera, Herz's arrangement of the "Carnaval de Venise," Mozart's Concerto in B flat (andante and finale), Weber's Concerto in E flat, and Weber's Concert Stück. In the performance of these, many beautiful and complicated passages, and at the same time extremely rapid ones, were played with a facility and grace which could not be too much admired. Although Mdlle. Secretain is as yet comparatively unknown to the British public, she has done enough to establish her reputation in this country as a charming and highly-talented musician, and we do not hesitate to say that she will long be known amongst us as one of our greatest professional favourites. By the introduction of such high-class talent, M. Rivière certainly entitles himself to the utmost possible success.

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THE PLANTERS' GAZETTE
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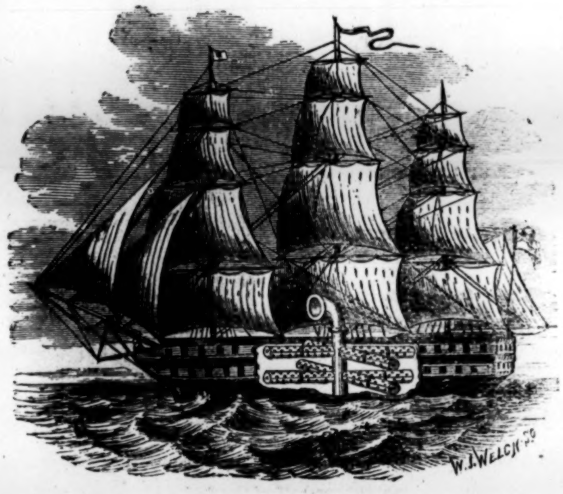

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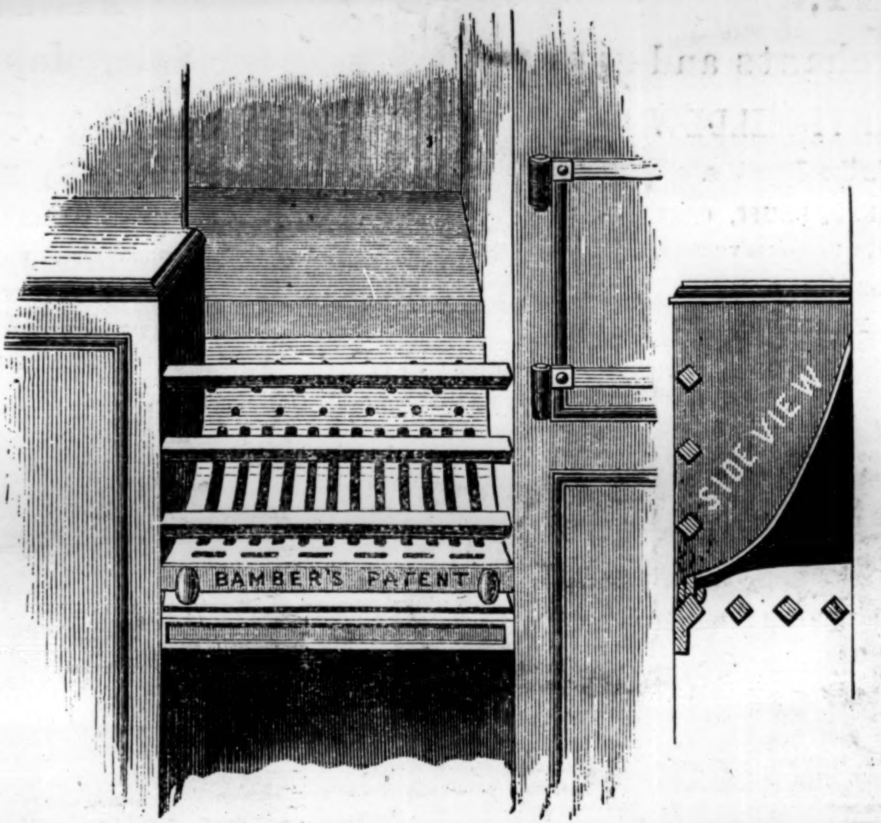

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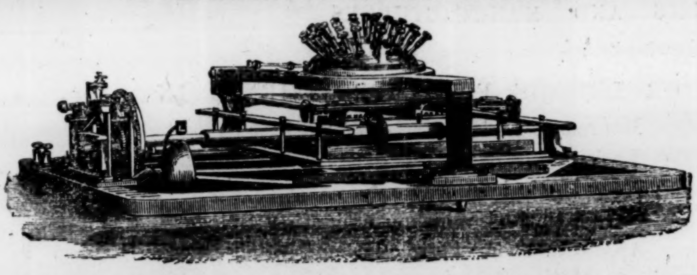

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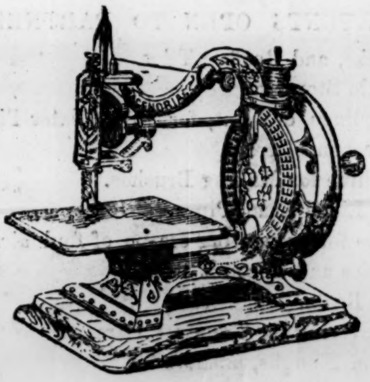

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